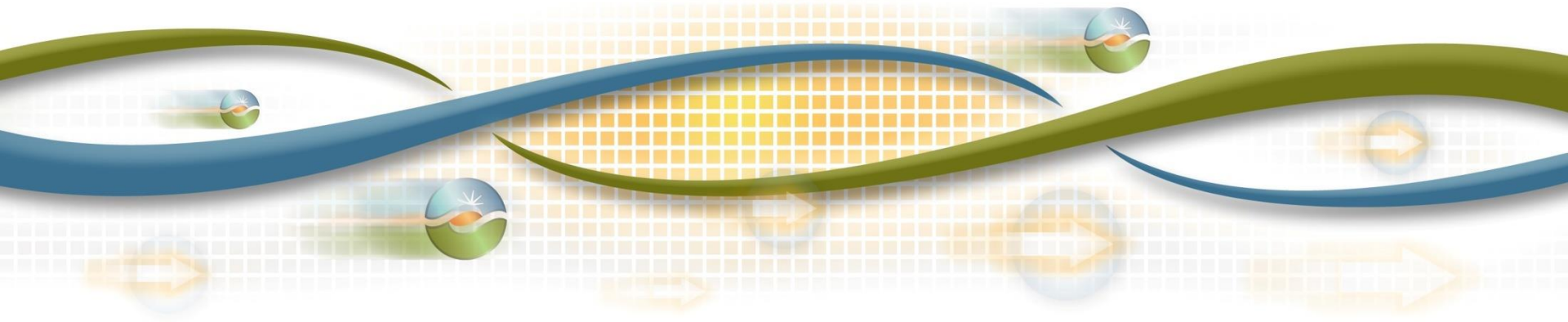




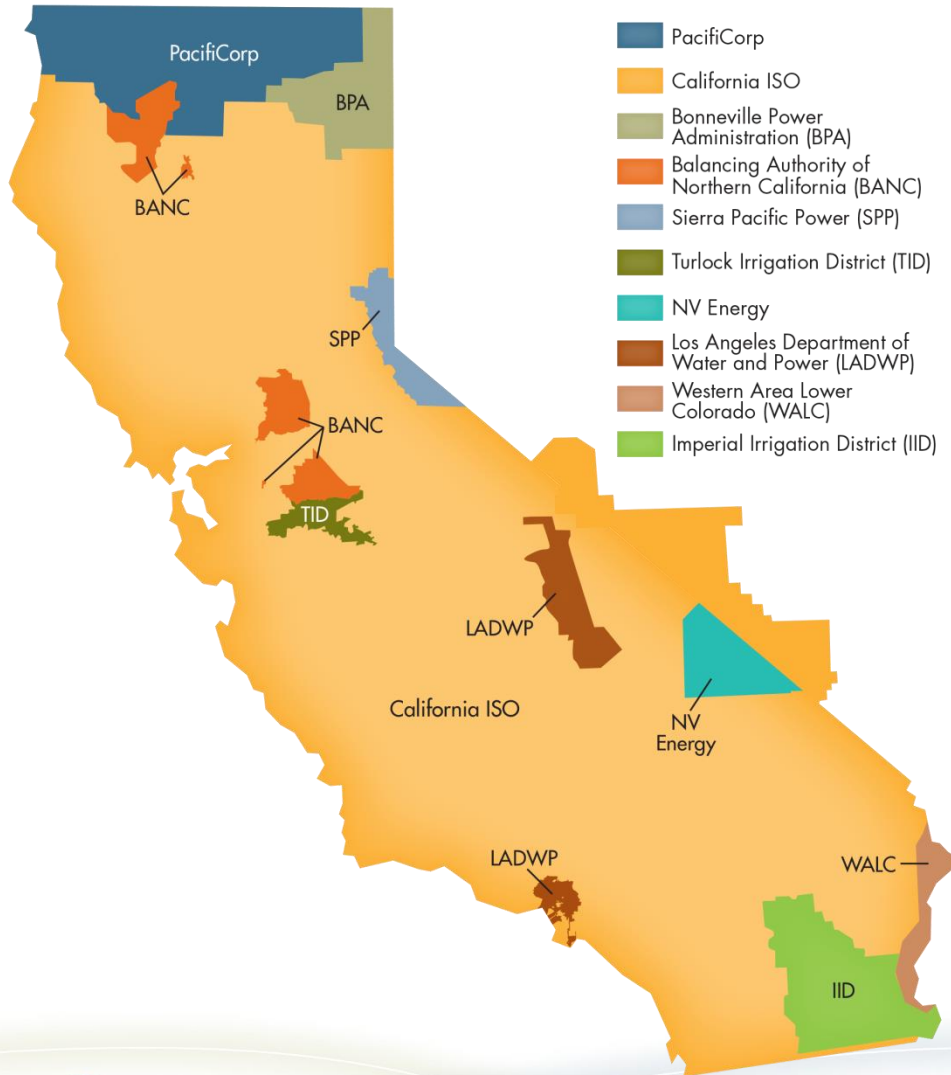
## **Multi-Agency Update on VGI Research**

Peter Klauer, Smart Grid Solutions Manager  
California ISO

California Energy Commission  
December 5, 2017



# CAISO by the numbers



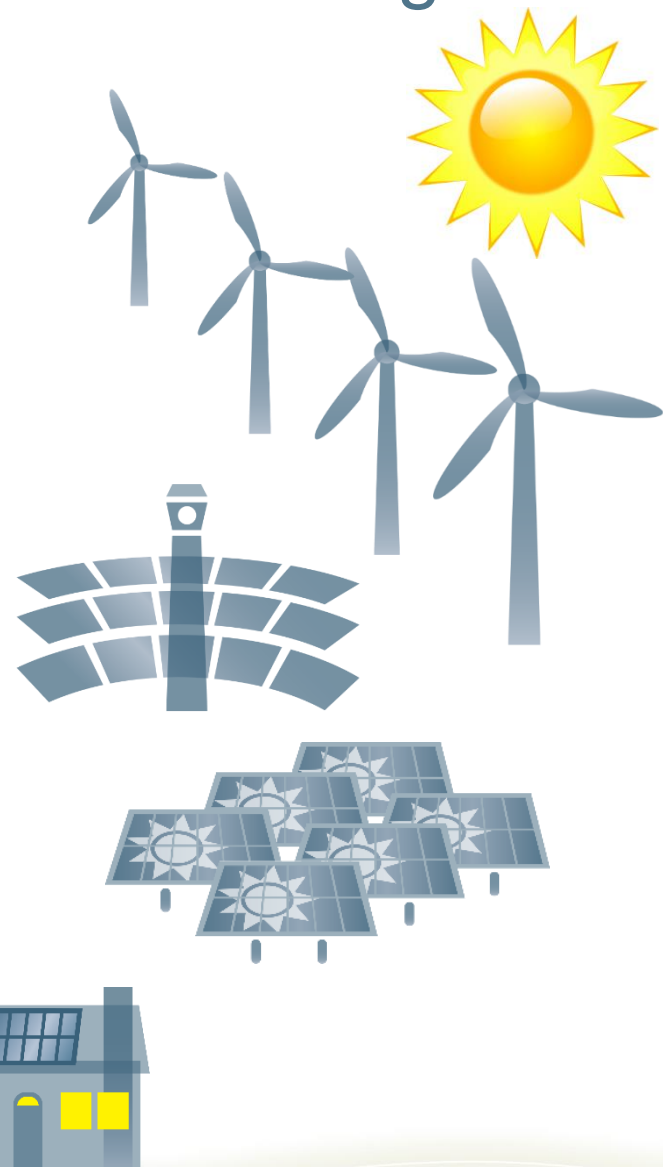
- Serves 80% of state
- 30 million consumers
- 26,000 miles of wires
- 71,548 MW installed capacity
- 56,830 MW resource adequacy
- 27,000 market transactions per day
- \$9 billion market

# California energy and environmental policies drive renewable integration and transmission needs

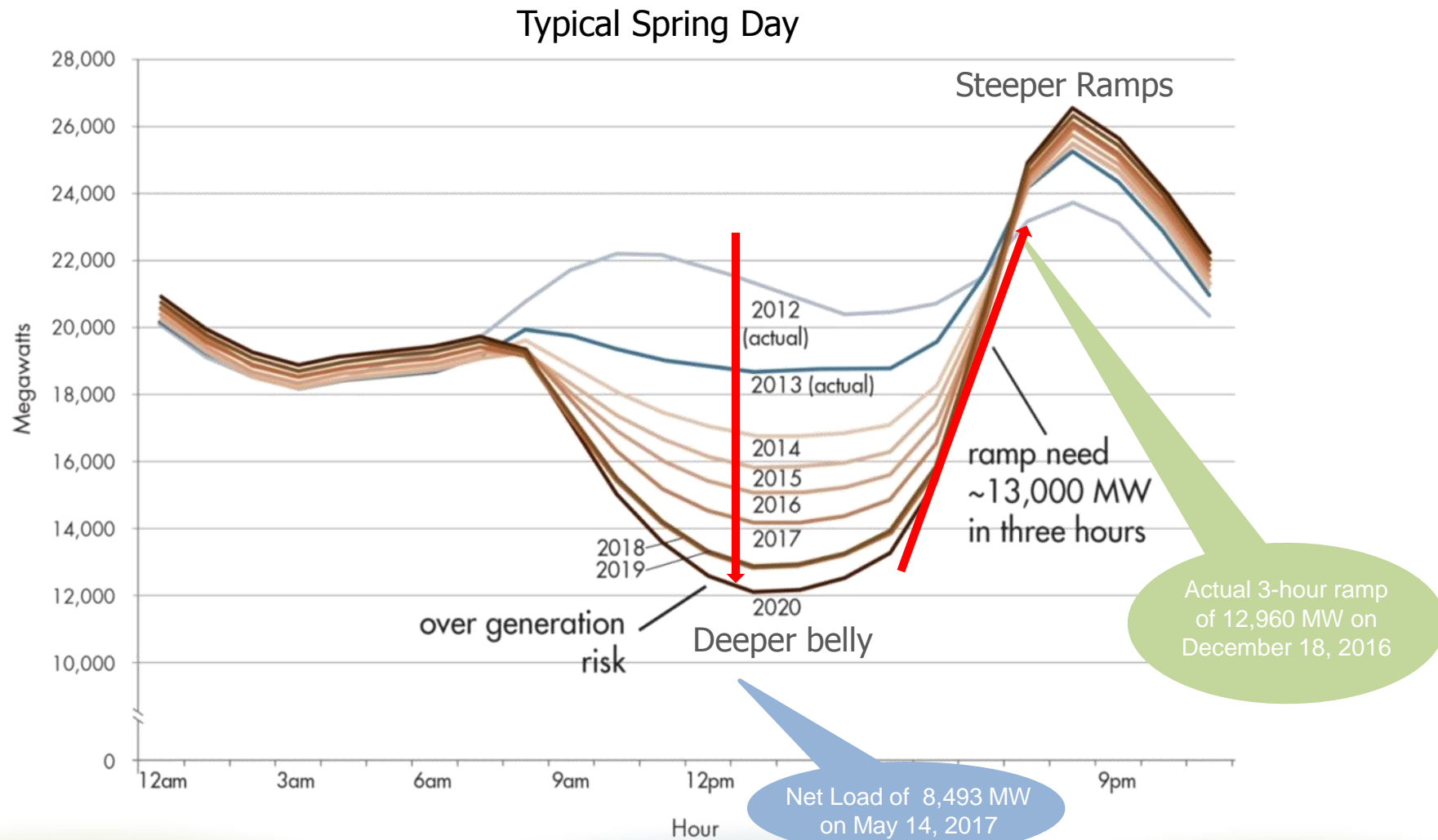
- 2020 Policies
  - Greenhouse gas reductions to 1990 levels
  - 33% of load served by renewable generation
  - 12,000 MW of distributed generation
  - Ban on use of once-through cooling in coastal power plants
  - Over 1,300 MW of electricity storage resources deployed by 2024
  - **1.5 million electric vehicles on the road by 2025**
- 2030 Policy Goals
  - 50% of load served by renewable generation
  - Double energy efficiency existing buildings
  - Greenhouse gas reductions to 40% below 1990 levels

# Major progress in meeting CA's renewable goals

- Currently Installed:
  - 20,000 MW of utility-scale renewables
  - 6,000 MW of consumer rooftop solar
- 67.2% of demand served by renewables at 2:55 pm, May 13, 2017
- Additional renewables:
  - 3,000 MW expected to meet 33%
  - 12,000-16,000 MW estimated to meet 50%
  - 3,000 MW of consumer rooftop solar estimated by 2020

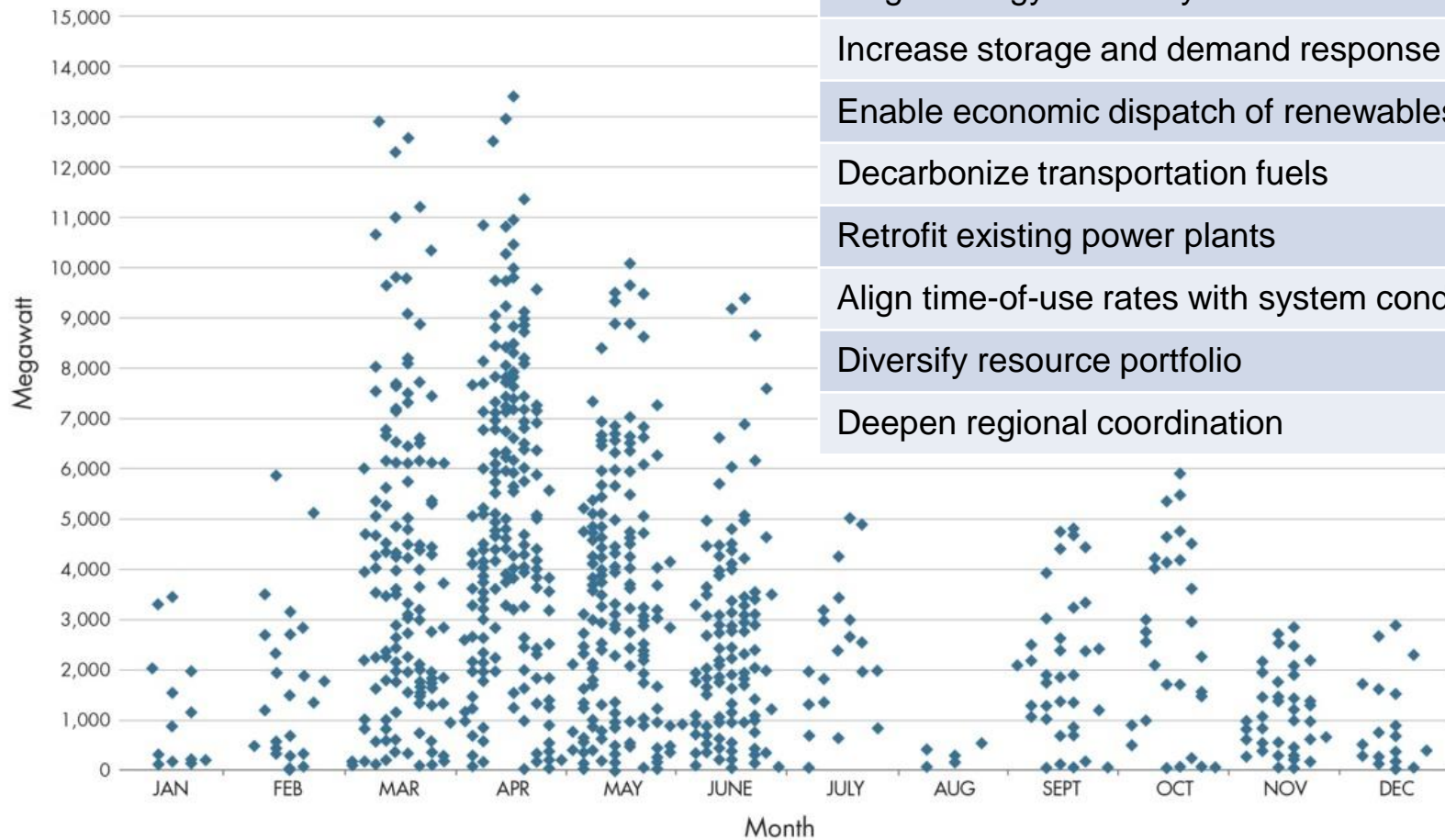


# Oversupply and ramping: A new challenge as more renewables are integrated into the grid





# Renewable curtailment in 2024 at 40% RPS is significant



## Solutions

Target energy efficiency

Increase storage and demand response

Enable economic dispatch of renewables

Decarbonize transportation fuels

Retrofit existing power plants

Align time-of-use rates with system conditions

Diversify resource portfolio

Deepen regional coordination

# The ISO is supportive of EV related research, pilots, and demonstrations.

- SCE, PG&E, SDG&E, EVSE Developers, EV Service Providers
  - EV resources participating in ISO Wholesale Market
    - EV's under demand response products (load curtailment)
    - EV's under Storage participation models
- Technical Advisor to CEC, DOE, University, and National Laboratory projects and research efforts
- Participating in EV related CPUC proceedings, working groups, and pilots
- Member of the Public Policy Board of Veloz (formerly PEV Collaborative)

# Demonstrating EV wholesale market participation for energy and regulation services

- Los Angeles Air Force Base

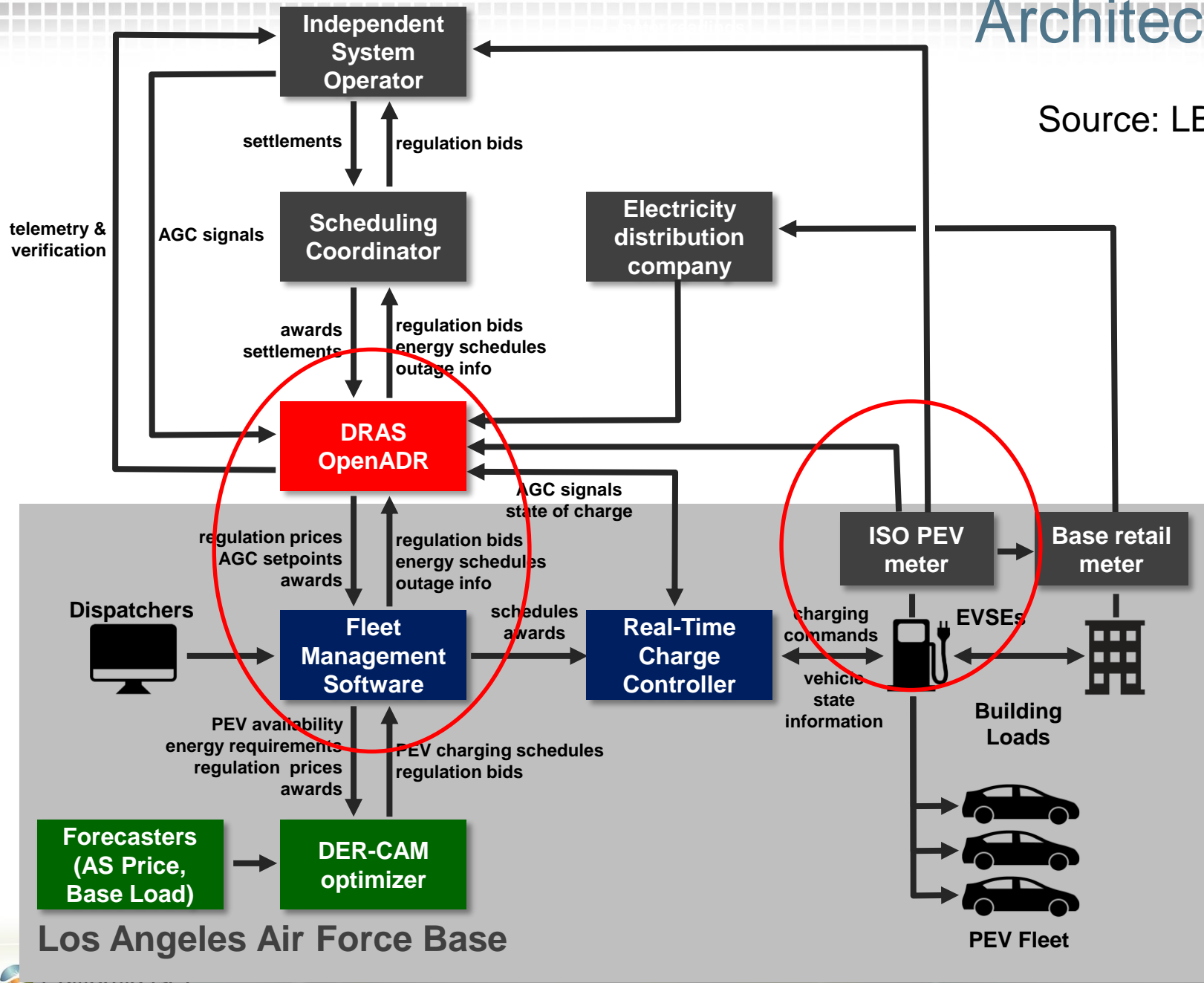
- Bi-directional power flow (V2G)
- 500-600 kW capacity
- V2G capable sedans, trucks, vans
- Began ISO Market Participation December 2015
- Partnership effort between DOD, SCE, CPUC, CEC, ISO, Lawrence Berkeley National Labs, Kisensum, and others.
- Completed ISO Market Participation Phase 9/30/17
- Report in progress





# Architecture

Source: LBNL



# Timeline of CAISO initiatives

Year	Initiative	Description
2013	Expanding Metering and Telemetry Options – Phase 1	Simplifying requirements for smaller resources to meet ISO telemetry and metering requirements
2015 - 2016	Expanding Metering and Telemetry Options – Phase 2	Created the Distributed Energy Resource Provider (DERP) to facilitate aggregation of smaller resources in the CAISO market
2015-2018	Energy Storage and Distributed Energy Resources (ESDER) Phase 1 & 2 & 3	Enhancements for CAISO connected and distribution connected resources to participate in the CAISO market under NGR and PDR modeling  Phase 3 scope includes a load shift/consumption capability for PDR

# Expanding Metering and Telemetry Options

## EMTO – (Distributed Energy Resource Provider)

### Purpose:

- Create a pathway for smaller resources to be bundled by utilities or third parties and collectively meet the half-megawatt minimum requirement for participating in the energy market.

### Scope:

- Establishes a new market participant identity to aggregate and represent distributed energy resources
- Allows for expanded use of non-ISO meters and avoids a direct metering relationship with the ISO
- Establishes resource aggregation rules at an ISO network level

FERC Approved June 2016

# ISO Stakeholder Initiatives have direct impact on the development of EV grid resources

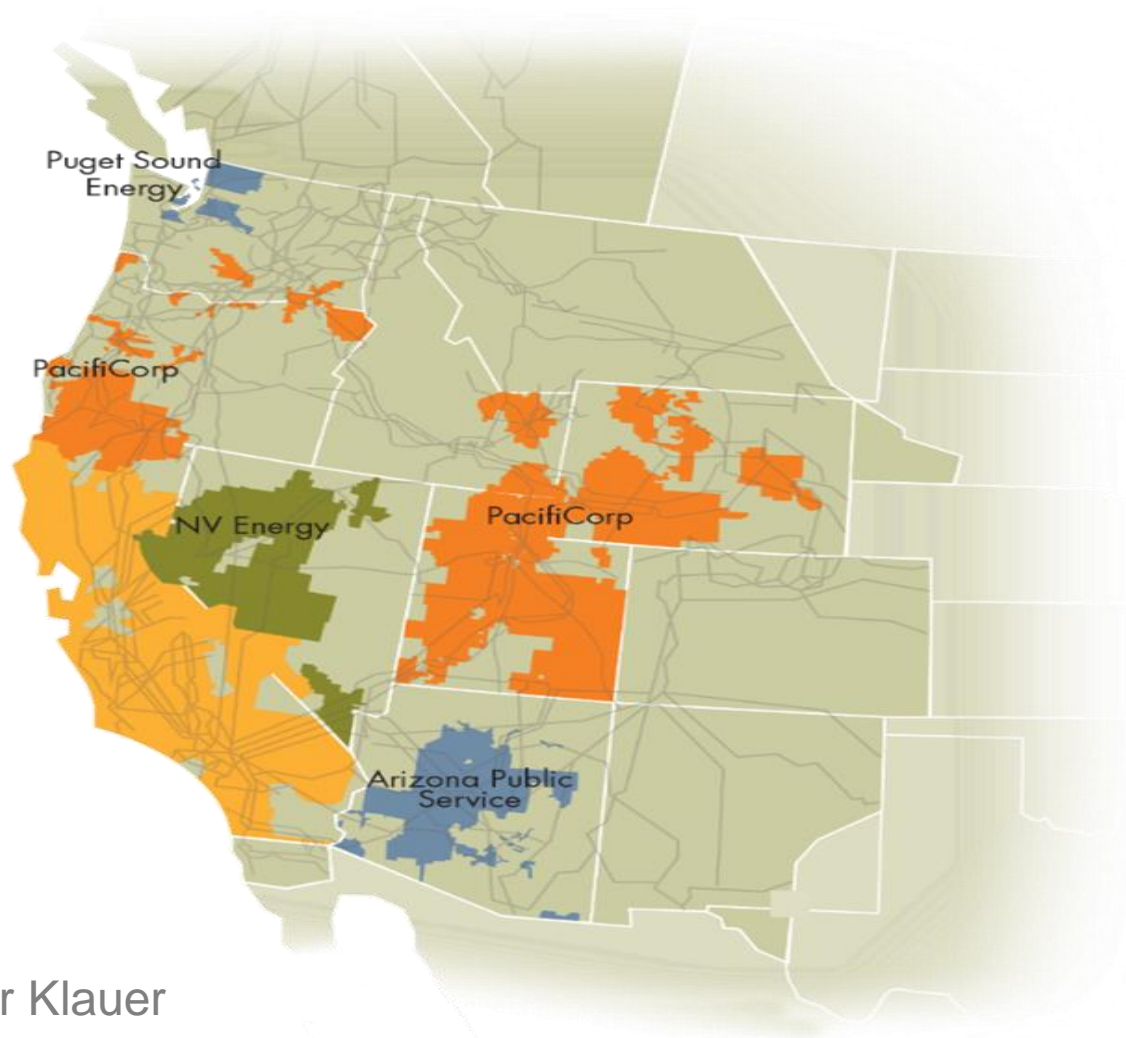
- Energy Storage and Distributed Energy Resources
  - ESDER
  - [http://www.caiso.com/informed/Pages/StakeholderProcesses/EnergyStorage\\_AggregatedDistributedEnergyResources.aspx](http://www.caiso.com/informed/Pages/StakeholderProcesses/EnergyStorage_AggregatedDistributedEnergyResources.aspx)
- Expanding Metering and Telemetry Options
  - Distributed Energy Resource Provider (DERP)
  - <http://www.caiso.com/informed/Pages/StakeholderProcesses/ExpandingMetering-TelemetryOptions.aspx>

# FERC NOPR

On November 17, 2016 FERC issued a notice of proposed rule making to require ISOs and RTOs to:

- Establish a participation model that recognizes the physical and operational characteristics of electric storage resources
- Define distributed energy resource aggregators as a type of market participant that can participate in the organized wholesale electric markets under a participation model that best accommodates the physical and operational characteristics of its distributed energy resource aggregation
- ISO filed comments to this NOPR in January

# Questions?



Contact: Peter Klauer  
[pklauer@caiso.com](mailto:pklauer@caiso.com), (916) 608-1104



# The CAISO faces four related operational challenges

## 1. Downward ramping capability

Thermal resources operating to serve loads at night must be ramped down and potentially shut down to make room for a significant influx of solar energy at sun rise.

## 2. Minimum generation flexibility

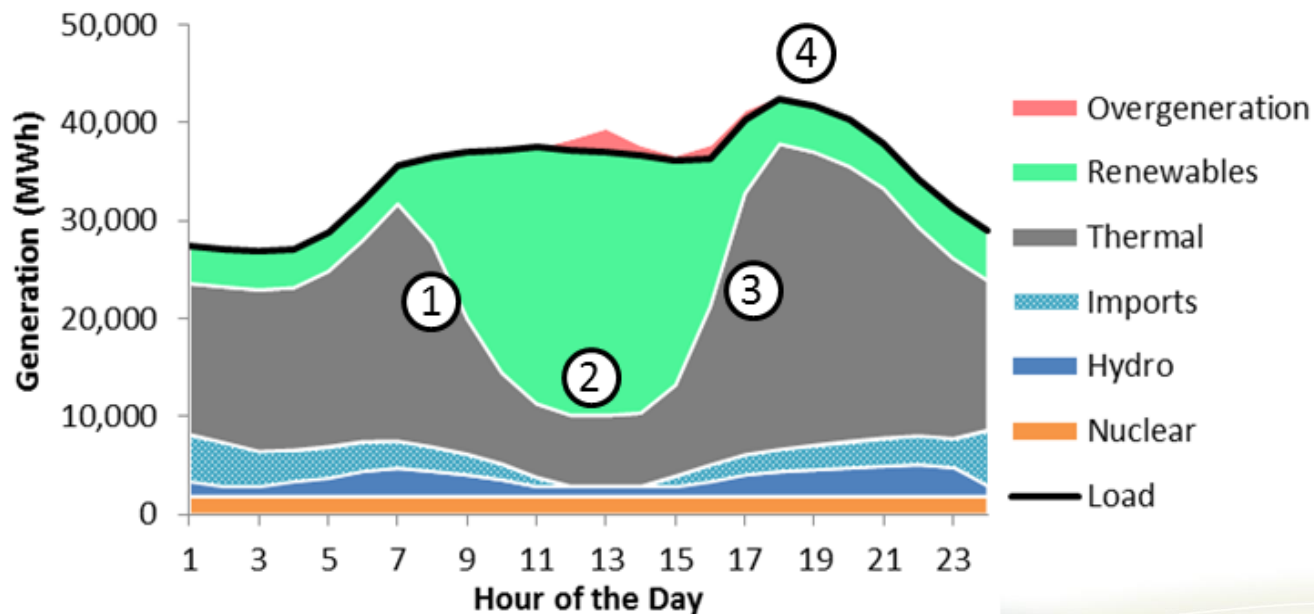
Over-generation may occur during hours with high renewable production even if thermal resources and imports are reduced to their minimum levels. A system with more flexibility to reduce thermal generation  $P_{min}$  will incur less over-generation.

## 3. Upward ramping capability

Thermal resources must ramp quickly from minimum levels during daytime hours and new units may be required to start to meet high net peak demand occurring shortly after sundown.

## 4. Peaking capability

The system will need enough resources to meet the highest net-loads with sufficient reliability



# Energy Storage and Distributed Energy Resources

## ESDER

### Purpose:

- Enhance the ability of transmission-connected storage and distribution-connected resources to participate in the ISO market.

### Scope:

- Enhancements to the non-generator resources (“NGR”) market participation model
- Enhancements to demand response performance measures and statistical sampling (“PDR” and “RDRR”)
- Clarifications to rules for non-RA multiple-use applications (provision of both retail and wholesale services by the same resource)

# Expanding Metering and Telemetry Options - EMTO

## Distributed Energy Resource Provider - DERP

